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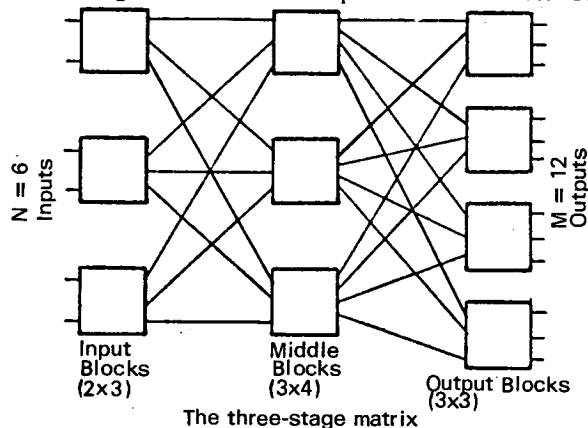
Marshall Space Flight Center



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Stored Program Concept for Analog Computers

A design concept provides for automatically interconnecting computing component inputs and outputs in a general-purpose analog computer by means of a three-stage matrix of two-position switches. The



technique could aid rapid problem setup and simplify analog simulations. Users of existing analog computer installations, particularly in the automotive and transportation industries, should find application for this approach.

Originally, the effort centered on investigating the feasibility of an automatic patching system for an analog or hybrid computer, using fewer switches than usually required. Manual patching was regarded as too complex and specialized, in addition to being aesthetically unattractive. Automatic patching could produce an approach to the programming of analog and hybrid computers in a manner analogous to that used in programming digital computers. This could result in wider availability of analog and hybrid computation in software usage, as well as simplification of existing analog and hybrid equipment.

The objectives of the study were achieved by a combination of three design techniques: three-stage matrices, modularization, and black boxes. The particular type of three-stage matrix used is illustrated in the figure. Input, middle and output blocks were utilized, with the middle blocks making connections between specific input and output blocks. A significant theoretical reduction in the number of required switches resulted from the use of this matrix.

The computer for the present automatic patching system was divided into modules (identical or near identical subsets), each of which was provided with its own internal matrix for connecting components. The entire computer was then given a single external matrix forming connections between the modules. The three-stage matrices theory could be applied to either or both the internal or external matrices, depending on the desired reduction in switches and the expected complexity of problems to be solved.

The need for simplified analog computing components has been approached by connecting an adjustable potentiometer to each input of every summer and integrator. This could result in a significant reduction in the number of input and output connections requiring switches. The black box approach was also proposed, for use with the multiplier. The optimization of the three-stage matrices, modularization, and black boxes, could produce an automatic patching system which is relatively inexpensive and less complex than previous techniques. The smallest system heretofore considered involved over 20,000 switches. The present design uses approximately 8,000 switches for a fairly large analog computer (the EAI 680).

(continued overleaf)

Note:

Requests for further information may be directed to:

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